



PIPE ID CONTROL SYSTEM

RF096-35/55-100 Series

User's manual

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Certified according to ISO 9001:2015



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1. Safety precautions

- Use supply voltage and interfaces indicated in the system specifications.
- In connection/disconnection of cables, the system power must be switched off.
- Do not use the system in locations close to powerful light sources.

2. CE compliance

The system has been developed for use in industry and meets the requirements of the following Directives:

- EU directive 2014/30/EU. Electromagnetic compatibility (EMC).
- EU directive 2011/65/EU, "RoHS" category 9.

3. Laser safety

The system makes use of an c.w. 660 nm wavelength semiconductor laser. Maximum output power is 1 mW. The system belongs to the 2 laser safety class according to IEC/EN 60825-1:2014. The following warning label is placed on the housing:



The following safety measures should be taken while operating the system:

- Do not target the laser beam to humans.
- Do not disassemble the laser sensor.
- Avoid staring into the laser beam.

4. General information

The system is designed for non-contact scanning and inner diameter measurement of the pipes.



5. Basic technical data

P	Value		
Measured ID range, mm		3555	
ID measurement accuracy, mm	l	±0.05	
Angle scan resolution, points for	3200		
Pipe depth, mm		100	
Linear translation accuracy, mr	n	±0.05	
Laser sensor linearity, µm		±15	
Laser sensor resolution, µm		3	
Laser sensor sample frequency	v, Hz	9400	
Light source	red semiconductor laser, 660 nm wavelength		
Laser sensor output power, mV	V	1	
Laser safety class		2 (IEC60825-1)	
Interface		Ethernet and PROFINET	
Power supply, V		220	
Measurement time, s		<5	
Environmental resistance	Vibration	20 g / 10…1000 Hz, 6 hours for each of XYZ axes	
	Shock	30 g / 6 ms	
	Permissible ambient light, lx	30000	
	Relative humidity, %	5-95 (no condensation)	
	Operating ambient temperature, ° C	0+45	
	Storage temperature, °C	-20+70	
Weight (without cables), gram		6800	

Note: System parameters can be changed for a specific task.

6. Example of item designation when ordering

RF096-Dmin/Dmax-L

Symbol	Description
Dmin/Dmax	ID measurement range, mm.
L	Measurement depth, mm.

Example: RF096-35/55-100 - Pipe ID Control System, ID measurement range - 35...55 mm, measurement depth - 100 mm.



7. Structure and operating principle

Operation of the system is based on scanning the pipe inner surface with a rotating triangulation laser sensor.

The system contains a base on which the linear translation mechanism, the controller and the interface module are installed. The linear translation mechanism carries the rotation module on which the laser sensor is mounted. On the back of the system there are four connectors for power and interfaces.



The system operates as follows.

The measured pipe is installed coaxially with the laser sensor. At the command of an external controller, the laser sensor moves into the hole. The sensor begins to rotate and scans the inner surface of the pipe, transmits the polar coordinates of the surface (distance from the axis of rotation measured by the sensor and the corresponding angle of rotation) to the built-in computer to calculate the required geometric parameters. The result is transmitted to the external controller via PROFINET.

8. Connection

- Connect the system to your controller.
- Connect the power cable to the system.
- Connect the system to 24V DC by using the special power cable.

The block diagram is shown below. In this diagram, I-7580 module is PROFINET IO device of the system, and PLC is S7-1200 from Siemens. The program «Step 7 V11» provided by Siemens does the configuration and communication.





9. Network configuration

Configure the network as shown below:

PC	PLC	I-7580
-	Device name: PLC_1	Device name: i-7580
IP: 192.168.1.210	IP: 192.168.6.211	IP: 192.168.1.212
Mask: 255.255.0.0	Mask: 255.255.0.0	Mask: 255.255.0.0

9.1. PC

- 1. Select Start Menu > Control Panel > Network and Sharing Center. (For Windows 8 and higher, search for Control Panel, and select Network and Internet).
- 2. Click Change adapter settings.

Control Panel Home	View your basic network in	formation and	set up conne	ctions	¢
Change adapter settings	i 👰 ——				See full map
Change advanced sharing settings	USERCBU12-PC (This computer)	NETGEAR50-5G		Internet	
	View your active networks			Con	nect or disconnect
	NETGEAR50-5G		Access type:	Internet	
	Public network		Connections:	📱 Local Area C	onnection 2
	Change your networking settings -				
See also	Set up a new connection	or network			
Line Course					

3. Right-click on Local Area Connection and select Properties.



4. Select Internet Protocol Version 4 (TCP/IPv4) and click on Properties.

Configure This connection uses the following items:	Networking Sharing Connect using:
Cos Packet Scheduler Gos Packet Scheduler General NDIS Protocol Driver General NDIS Protocol Driver Antemet Protocol Version 6 (TCP/IPv6) General NDIS Protocol Version 4 (TCP/IPv4) Install Uninstall Properties Description Transmission Control Protocol/Internet Protocol. The default wide area network protocol that provides communication across diverse interconnected networks.	Configure This connection uses the following items:
Install Uninstall Properties Description Transmission Control Protocol/Internet Protocol. The default wide area network protocol that provides communication across diverse interconnected networks.	Gos Packet Scheduler Gos Packet Scheduler General NDIS Protocol Driver Antemet Protocol Version 6 (TCP/IPv6) Antemet Protocol Version 4 (TCP/IPv4) Antemet Protocol Versi 4 (TCP/IPv4) Antemet Protocol Versi
	Install Uninstall Properties Description Transmission Control Protocol/Internet Protocol. The default wide area network protocol that provides communication across diverse interconnected networks.

5. Select **Use the following IP address** and enter the IP address, Subnet Mask, Default Gateway and DNS server.

Click OK and close the Local Area Connection Properties window.



ternet Protocol Version 4 (TCP/IPv4 General	4) Properties
You can get IP settings assigned aut this capability. Otherwise, you need for the appropriate IP settings.	tomatically if your network supports to ask your network administrator
Obtain an IP address automatic Obtain an IP address automatic	ally
IP address:	192.168.1.210
Subnet mask:	255.255.0.0
Default gateway:	192.168.1.1
Obtain DNS server address aut	tomatically
Use the following DNS server as	ddresses:
Preferred DNS server:	8.8.8.8
Alternate DNS server:	4 . 2 . 2 . 1
Vajidate settings upon exit	Advanced
	OK Cancel

9.2. PLC

1. Double-click the TIA icon to start Step 7 V11.



2. Click Project view.



3. Search for accessible devices.



4. Select PLC and click the Online & diagnostics button.



5. Set the IP address and the subnet mask.





6. Set the device name.

Diagnostics					
 Functions 		PRO	FINET device nam	e: plc_1	
Assign IP address			TVD	67.120	
Set time of day			-16	57-120	
Reset to factory settings Assign name		_			
		Ste	p2: Input d	evice name	
			Only show device	s of the same type	
			Only show device	s with bad parameter se	ttings
Step1: Click Assign name			Calcabase davias		
			Only show device	s without names	
1					
-	Acce	ssible devices in the ne	twork: 🔁		
		MAC address	Type	Name	Status
	IP address	MAC BOORESS	ijpe		
	IP address	MAC address	Step3:	Click "Assign na	me" button
	IP address	MAL BOOTESS	Step3:	Click "Assign na	me" button
	IP address	MAC BOOTESS	Step3:	Click "Assign na	me" button
	IP address	MAL BOORESS	Step3:	Click "Assign na	me" button
	IP address	MAC BOOKSS	Step3:	Click "Assign na	ime" button
	IP address	MAC BOORESS	Step3:	Click "Assign na	me" button

9.3. I-7580 module

1. Search for accessible devices.



2. Select I-7580 module and click the Online & diagnostics button.



3. Set the IP address and the subnet mask.



oject tree	□ 4	Online access + Intel(R)	PRO/1000 MT Network Conn	ection 🔸 i-7580 [12-34-56-78-9A-8C]
Devices				
Devices Ocide Construction Ocid	master c	Diagnostics General <u>Functions</u> Assign IP address Assign name Reset to factory setti on IP address	Assign IP address MAC address IP address Subnet mast Router address Ste but	Step2: Set IP & Mask

4. Set the device name.

Online access → Intel(R) PRO/1000 I	dT Network Conne	ection → i-7580 [12	-34-56-78-9A	-BC]	
Diagnostics General Functions Assign IP address Assign name Reset to fay ony settings		PRO Step2: I	FINET device na	pe: 17580 17580 e name	
Step1: Click Assign name			Only show devi	ces of the same type	
			Only show devi Only show devi	ces with bad parameter se ces without names	ttings
	Acce	ssible devices in the ne	twork: 🔁		
	IP address	MAC address	Type	Name	Status
			[Step3: Click "Assig	n name" button
					4
				LED flashes	Assign name
<					

10. GSD import

Please follow the steps to import the GSD file:

Step 1: Get the GSD file

The GSD file can be downloaded from an FTP site: <u>ftp://ftp.icpdas.com/pub/cd/fieldbus_cd/profinet/converter/i-7580/gsd/</u>

Step 2: Import the GSD file

1. Double-click the TIA icon to start Step 7 V11.



2. Click Project view.



3. Select Menu > Options > Install general station description file (GSD).



4. Select and install the GSD file.

Install general	station description	file				×
Source path:	C:\GSD					
Content of im	ported path				/	
GSDML-V2.3	-ICPDAS-I7580-20140	Ver Step	1: Select th	ne GSD file	directory	FINET I
Step2: Sele	ect the GSD file					
		-	Ste	ep3: Click "	Install" bu	utton
					Install	Cancel

11. Project setup

Please follow the steps to setup the project:

Step 1: Create the project

1. Double-click the TIA icon to start Step 7 V11.



2. Create the project.

	Create new project						
Open existing project	Project name: Path:	Clusers	Stan 2	Toput project pame			
 Create new project Migrate project 	Author: Comment	Ryan	Step2.	Input project name			^
Close project		_					~
Step1: Select "Creat	e new project"			Step3: Click "Creat	te" button]▶∟	Create
 Welcome Tour First steps 							

Step 2: Project configuration

1. Add the PLC device.





2. Select Add new device.



3. Set the PLC name to «PLC_1».



		🚰 Topology view	<u>_</u>
Network	💌 👯 🔛 🍳 ± 100% 💌		
PLC_1			
CPU 1211C	Step1: Select "F	roperties"	
	oup. out i	-operates	
	\		
Step2: Select "General			
PLC_1 [CPU 121 C AC/DC/Rly]		Q Properties	1 Ir
General			
	Step3: Input device name		
Cotalegingermation	General		
PROFINET interface	Project information		
DI6/DQ4			
▶ AJ2	Name: PLC_1		
 High speed counters (HSC) 	Author: icpdas		
 Pulse generators (PTO/PWM) 	Comment		
Startup	- Comment.	~	
Cycle			
Communication load	-		
System and clock memory			
 Web server 			
Time of day		•	
Protection	PositionNumber: 1		
Connection resources			
Overview of addresses	Catalog information		
A Portal view	- Devices & ne		
Tortal VIAW	m vences a ne		

4. Set the IP address and the subnet mask for PLC and add the new subnet.

PLC_1 CPU 1211C		
Step1: Selec	t "PROFINET interface" ->	"Ethernet addresses"
Ceneral PROFINET interface General Ethernet addresses Advanced Time synchronization DI6/D04 Ster	Ethernet address Interface netw	ses
Al2 High speed counters Pulse generators (PTO/PWM) Startup		 Set IP address in the project
Cycle Communication load System and clock memory Web server	Step3: Set IP &	IP eddress: 192.168.1211 Subnet mask: 255.255.00 Use IP router Router eddress:
Time of day	Overview	Set IP address using a different method

5. Add the I-7580 module.

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6. Select the PROFINET interface.

				🛃 Topology view	🔥 Neti
💦 Network 🚹 Connections	HMI connection	- 🖫 🖽 🤆	2 ± 100%		
PLC_1	1-758	10	1072		
	Note	assigned			
	A	PLC_1.PROF	INET interface_1		
PN/IE_1			- X		
			```	<b>`</b>	
	/			<u>\</u>	_
Step	1: Click "Not assi	gned"	Step2: Se	ect "PLC_1.PROF	INET
			interface_	1	

7. Set the device name to «i-7580».



				đ	IO system: PLC_	_1.
PLC_1 CPU 1211C	I-7580 I-7580 2-Port D PLC_1	<u></u>	•	Step1: C I-7580 ic	lick on	
I-7580 General FROMMET Interface [X1] General	elect "General"		<u>.</u>	Properties	1 Info	2
Ethernet addresses Advanced options Identification & Maintenance	/	Author:	icpdas			
Step3: Inp	out device name					

8. Set the IP address for the I-7580 module.

		IO system: PLC_1.PROFINETIC
PLC_1 CPU 1211C	H7580 H7580 2-Port D PLC_1	
1-7580		💁 Properties 🔛 Info 🖳 Diagnos
General	Step1: Select "PROFINET -> "Ethernet addresses" Subnet:	Interface"
	IP protocol	
Step2: Input I	P address	Use IP router

9. Set the module type for the I-7580 module.

							Topology view	Network view	Device view	Options	
						Device view					
Dev	vice overview					[m. 1.0.]				✓ Catalog	
	Module	Reck	Slot	Laddress	Q addre.	Step1: Se	lect "Device view"	mware Co	mment	<search-< th=""><th></th></search-<>	
		0	0			1-751		3.0		Ser Filter	
	Internal	0	0.X1			1-7580				I-7580 2-Port Device	
	RSW.0 Input 328yte Output	. 0	1	132	182	RSW:0 Input:328yte				<ul> <li>Input And Output Modules</li> </ul>	
									-		٦.
									-	KIW: 1 Inputs48yte Outputs48yte	
							Step	2: Select m	odule type	ISW 3 Input 2568ute Output 2568ute	
							and	double click	this icon to	RSW.4 Input 3848yte Output 3848yte	
							add	module		RSW:5 Input:5128yte Output:3848yte	

## 10. Set parameters for the I-7580 module.

Daulas augudau					Step1: Clic	k mod	lule		
Y Module ▼ 1-7580	Rack 0	Slot 0	I address	Q addre	Type 580 2-Port Device 1-7580	Order n I-7580	0.	Firmware v3.3.0	Comment
RSW: 1 Input:64Byte Output	0	1	164	164	RSW: 1 Input:648yte		Step3: Set parameter	Module s	
SW:0 Input:328yte Output:328yte_1 General							/	🤦 Properti	es 违
General Module parameters VO addresses		Module Gene	e paramete ral param	ers					
				Baud ra	ate: 115200			•	
tep2: Click "Module				Data	bit: 8 data bit				
parameters"			End cha	Stop	bit: 1 stop bit			•	
			End one	r or input of	None				
			Input fixe	d length de	ata: Disable				
			Input fixe Unit of	ed length de timeout val	ue: 1 ms				

## 11. Compile and download to the device.



tended download t	a device				
	Configured acce	iss nodes of "PLC_1"			
-	Device	Device Note	hee	Address	Subset
	B.C.1	05U1211CA0DC	Photo:	1921684.211	Pade 1
	100.01				
	Step1: Sele	ct network interfa			
		''	pe of the PGP	interface:	
			PGP	interface: Dirocit	PROFILED WE NOT .
			Concession .	market India 1	
			Connection	to subnet	
E	Step2: Select	PLC			
	Accessible devi	ces in target subnet			Suow all accessions devices
	Device	Device type	Type	Address	Target device
	PLC_1	OPU 1211C A0DO	PNIE	192.168.6.211	R.C.1
× 5	-	-	PNIE	Access address	-
Flash LED					
11011-000					
	_				
					Befresh
Onlaw motor adversation:					<b>_</b>
Connected to add	ess 192.168.6.211		Step2: Ci	ck "Load" butto	n
Scanning ended.					
				$\langle \cdot \rangle$	
				X	Load Cancel
				1	





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# 12. Communication

# 12.1. Communication sequence

The I-7580 module basically contains 4 buffers:

- PROFINET IO device input buffer.
- PROFINET IO device output buffer.
- COM port input buffer.

• COM port output buffer.

The PROFINET IO controller basically contains 2 buffers:

- PROFINET IO controller input buffer.
- PROFINET IO controller output buffer.

In the I-7580 module, data is transferred from the COM port input buffer to the PROFINET IO device output buffer, and from the PROFINET IO device input buffer to the COM port output buffer. The data flow is illustrated below.



During each message cycle, the PROFINET IO controller writes the content of its output buffer to the PROFINET IO device input buffer and reads the content of the PROFINET IO device output buffer to its input buffer. The exchange cycle is taking place even though the content of the PROFINET IO controller and PROFINET IO device output buffer has not changed. The data flow between the PROFINET IO controller and the I-7580 module is shown below.





# 12.2. PROFINET Input Data Area

The maximum input data length of I-7580 is 512 bytes. The first 8 bytes of the received input data are reserved for the communication status. The remaining data in the input data area represents the data packet received from the serial network. The 9th byte therefore shows the first byte of the received serial data.

Byte	Data	Description
	0x00	I-7580 does not transmit I/O data.
0	0x01	I-7580 transmits data to the COM port.
	0x02	I-7580 receives data from the COM port.
1	Error State	Bit 0: Output FIFO overflow Bit 1 : Input FIFO overflow Bit 2 : Output Data loss Bit 3 : Input Data loss Bit 4 : Input Data overflow
2	Longth	Received data length (High byte)
3	Lengin	Received data length (Low byte)
4	Input	Received data count (High byte)
5	Count	Received data count (Low byte)
6	Output	Transmitted data count (High byte)
7	Count	Transmitted data count (Low byte)
8~511	Data	Receive data from the COM port

The I-7580 module has three modes to identify data from two batches of data packet. These modes are: (1) Interval time, (2) Fixed data length, and (3) End character of data.

# 12.2.1. "Interval time" mode

If the time between two consecutive bytes exceeds the timeout value, the module transfers the data from the COM port input buffer to the PROFINET IO device output buffer. The default timeout value is set to the duration needed to send one data byte. That means if after a time period of one byte no additional data arrives, then the data that is already in the COM port input buffer will be regarded as a data packet.

The interval time between messages arriving at the COM port must be greater than 2 milliseconds.

## 12.2.2. "Fixed data length" mode

The converter counts the number of bytes arriving at the COM port. If the specified amount of data has entered the serial input buffer, the content is removed from the input buffer and transferred to the PROFINET IO device output buffer. The last string will only be send after a transmit time of three bytes has elapsed. To use this feature, you need to set the "Input fixed length data" parameter to "Enable". The data length has to be defined in bytes 5-6 of the PROFINET output data area (please refer to section "PROFINET Output Data Area").



Fixed Length : 5 (byte 5, 6 of PROFINET output data area)



## 12.2.3. "End character" mode

As soon as the converter detects the end characters of the incoming serial data stream, it removes the data from the serial receive buffer and transfers it to the PROFINET IO device output buffer of the converter.

If the time interval between two consecutive bytes is longer than the time needed to transmit three bytes, then the module treats this situation as an end of a string.

To use this feature, the "End char of input data" parameter must not be set to "None".



# 12.3. PROFINET Output Data Area

The maximum output data length of I-7580 is 384 bytes. The first 8 bytes are needed to set the communication behavior of the converter.

Byte	Data	Description
1	0~255	Data output command.
	0x01	Control bit – clear all diagnostic messages.
2	0x02	Control bit – clear Received data count.
	0x04	Control bit – clear Transmitted data count.
3	Longth	Output data length (High byte).
4	Length	Output data length (Low byte).



5	F	Fixed data length (High byte).
6	Length	Fixed data length (Low byte).
7	0~255	Interval time between the two batches of the data.
8	0~255	Timeout value.
9~384	Data	Output data to COM port.

# 12.3.1. Data output command (byte 1)

The PROFINET IO Controller is cyclically polling the I-7580 module. The PROFINET IO Controller sends data from its output buffer to the input buffer of the converter. If no new data is put on the PROFINET IO Controller output buffer, the PROFINET IO Controller sends the same data in each polling cycle. Therefore, it is necessary for the converter to detect whether the data arriving at its PROFINET IO device input buffer has already been sent before or is new. The converter recognizes a new data packet when the value of the first byte differs from the previous data packet. A change of the first byte results in an immediate output of the newly arrived data (at the PROFINET IO device input buffer) to the serial COM port.

When the user wants to send a new data packet to the converter, the user should increase progressively the first byte (ex: 0->1, 1->2, 2->3, ..., 255->0), and the converter will send the new data packet to the serial COM port. If the user changes the first byte but doesn't increase progressively it (ex: 0->2, 1->3, 2->5), the converter will send a diagnostic message "Output data - data loss". This message informs the user that the PROFINET data may be loss.

### ATTENTION!

The converter will send no data to the connected serial devices if the content of the first byte of two consecutive PROFINET messages is identical. Even if the remaining bytes differ, no message will be forwarded to the COM port. The converter detects a new data packet only by checking the first byte.

# 12.3.2. Control bit (byte 2)

Bit 0: When this bit is set, all diagnostic messages sent by the I-7580 module will be cleared.

Bit 1: When this bit is set, the I-7580 module sets the **Received data count** to zero (please refer to section "PROFINET Input Data Area").

Bit 2: When this bit is set, the I-7580 module sets the **Transmitted data count** to zero (please refer to section "PROFINET Input Data Area").

Bit 3~7: The remaining bits have to be set to zero.

## 12.3.3. Output data length (byte 3, byte 4)

The default value for the output data length is 0. It has to be set for every single output command, otherwise no data will be sent to the COM port.

These two bytes determine the number of bytes copied from the I-7580 PROFINET IO device input buffer to the COM port output buffer. This means that regardless of the data length sent by the master, only the number of bytes specified in the third byte will be forwarded to the COM port.

# 12.3.4. Fixed data length (byte 5, byte 6)

These two bytes determine the length of the response data string. The converter waits until the data arriving at the COM port buffer has reached the specified length.

To use this feature, the "Input fixed length data" parameter has to be set to "Enable".

# 12.3.5. Interval time (byte 7)

This byte can increase the interval time between two batches of the data packet. It means the converter can delay the data output from PROFINET to the COM port. **Example:** Interval time – 15 ms.



# 12.3.6. Timeout value (byte 8)

The timeout is only relevant for the communication between the I-7580 converter and the serial network. The converter receives the response of the device at the COM port as a continuous data stream. A silent interval in the data stream exceeding the timeout value signals the converter the end of the message and forwards this message to its PROFINET IO device output buffer.

Valid values for the timeout: 0 to 255.

The value "0" represents the minimum value which equals the transmission time of one byte [(start bit+data bit+parity bit+stop bit)/Baudrate].

The value "1" assigns a timeout value of either 1 or 10 milliseconds depending on the chosen unit (1 or 10 ms).

The value "255" represents either 255 milliseconds (time unit: 1 ms) or 2550 milliseconds (time unit:10 ms).



This byte specifies the timeout for the data stream of the serial response. If the multiply responses are expected for every request sent by the converter, then the timeout applies to all these messages.

# 12.4. Communication between PLC and system

Communication between PLC and system:

Area	Data from PLC to System	า	Data from System to PLC		
byte	Description	Var Type	Description	Var Type	
0	Calibration diameter	Real	Last diameter read average	Real	
4		Real	Last diameter read minimum	Real	
8		Real	Last diameter read maximum	Real	
12	Measurement position (from a zero point of a pipe)	Real		Real	
16		Int		Int	
18		Int		Int	
20		Int		Int	
22		Int		Int	
24.0	Start calibration command	Bool	Calibration running	Bool	
24.1		Bool	Calibration Done	Bool	
24.2		Bool	Calibration error	Bool	
24.3	Start measure command	Bool	Measure running	Bool	
24.4		Bool	Measure Done	Bool	
24.5		Bool	Measure error	Bool	
24.6	New data transfer	Bool	New data transfer request read	Bool	
24.7		Bool	New transfer data read	Bool	
25.0	Abort measure	Bool	System error	Bool	
25.1	Move to zero	Bool	Move to zero running	Bool	
25.2		Bool	Move to zero Done	Bool	
25.3		Bool	Move to zero error	Bool	
25.4		Bool		Bool	
25.5		Bool		Bool	
25.6		Bool		Bool	
25.7		Bool		Bool	

# 12.4.1. General information

Every system error of the pipe control system must set the **System error** variable.

If this bit is raised up during any measurement, every cycle will be interrupted and measurement results will not be read.

If for any reason PLC sets the **Abort measure** variable during the measurement cycle, the pipe control system must finish the running procedure and move a laser sensor into a safe position. This can be done if the operator checks for any anomaly during the measurement cycle.



## 12.4.2. Data transfer

- PLC prepares variables with the new data according to production requirements: **Calibration diameter**, **Measurement position**.
- PLC requires to save the new data in the pipe control system by setting the **New data transfer** flag = TRUE and waits until the process is complete.
- The pipe control system sets **New data transfer request read** = TRUE and holds it until all data is read.
- When the pipe control system has finished reading the new data from PLC, it sets **New transfer data read** = TRUE and holds this flag waiting a reply from PLC.
- PLC reads that the pipe control system has completed the procedure and resets **New data transfer** = FALSE.
- The pipe control system resets variables **New data transfer request read** = FALSE and **New transfer data read** = FALSE.

## 12.4.3. Calibration

- PLC requires to perform the calibration procedure for the pipe control system by **Start calibration command** = TRUE and holds this flag until the process is complete.
- When the pipe control system starts the calibration cycle, it sets **Calibration running** = TRUE and holds it until the process is complete.
- When the pipe control system has completed the calibration process, it sets **Calibration Done** = TRUE and holds it waiting a reply from PLC.
- PLC reads that the pipe control system has completed the procedure and resets **Start calibration command** = FALSE.
- The pipe control system resets variables **Calibration running** = FALSE , **Calibration Done** = FALSE.

## 12.4.4. Measurement

- PLC requires to make a new measurement by **Start Measure command** = TRUE and holds the flag until the process is complete.
- The pipe control system starts the measurement cycle, sets **Measure running** = TRUE and holds it until the process is complete.
- When the pipe control system has completed the measurement process, it writes variables Last diameter average, Last diameter read minimum, Last diameter read maximum, sets Measure Done = TRUE and holds this flag until all the measurement data is read by PLC.
- PLC reads that the pipe control system has completed the measurement procedure and resets **Start Measure command** = FALSE.
- The pipe control system resets variables **Measure running** = FALSE, **Measure Done** = FALSE.

## 12.4.5. Go to zero

- PLC requires the pipe control system to go to a zero position, sets **Move to zero** = TRUE and holds this flag until the process is complete.
- The pipe control system starts to move a laser sensor to a zero position, sets **Move to zero running** = TRUE and holds the flag until the process is complete.



- When the pipe control system has completed the process, it sets **Move to zero Done** = TRUE and holds it waiting a reply from PLC.
- PLC reads that the pipe control system has completed the procedure and resets **Move to zero** = FALSE.
- The pipe control system resets variables **Move to zero running** = FALSE, **Move to zero Done** = FALSE.

# 12.5. Communication tests

The user can perform communication tests by connecting the system to the PC using the Ethernet connector.

## Step 1: Run SSH client

1. On the PC, we use "PuTTY" to test.

Reputity Configuration	? <b>×</b>
Category:	
Category: Session Logging Terminal Keyboard Bell Features Window Appearance Behaviour Translation Selection Colours Connection Proxy Telnet Rlogin Benson SSH	Basic options for your PuTTY session         Specify the destination you want to connect to         Host Name (or IP address)       Port         22         Connection type:         Raw       Telnet         Rlogin       SSH         Saved Sessions         Default Settings         Load         Default Settings         Delete
Serial	Close window on exit: Always Never Only on clean exit
<u>A</u> bout <u>H</u> elp	<u>Open</u> <u>C</u> ancel

2. Enter a host name 192.168.1.100 as shown below, and click **Connect** (**Open**).

Specify the destination you want to connect	t to	
Host Name (or IP address) Port		
192.168.1.100 22		
Connection type: ○ Ra <u>w</u> ○ <u>T</u> elnet ○ Rlogin ● <u>S</u> SH	◯ Se <u>r</u> ial	

## Step 2: Work with terminal

1. Write Login and Password: Login: pi Password: raspberry 2. After 5-10 seconds, when you see a picture as shown below (the process is restarted for a new session), press **Ctrl+C** to end it.



3. Enter the command «ps -a» to check if the «run» process is exited. If the process still works, kill it by the command «kill -9 XXX», where XXX – the number of the «run» process.

pi@raspberrypi	:~ \$ ps -a	
PID TTY	TIME C	CMD
501 ttyl	00:00:00 k	bash
705 pts/0	00:00:02 r	run
709 pts/0	00:00:00 p	s
pi@raspberrypi	:~ <mark>\$ kill -</mark>	-9 705

4. Run the test process: «LD_LIBRARY_PATH=. ./run_contest».

pi@raspberrypi:~ 🖇 LD	LIBRARY_PATH=/run_contest
2018-12-11 13:30:37	started
2018-12-11 13:30:37	plc port open
2018-12-11 13:30:37	motor connected, type 99, sn 118
2018-12-11 13:30:37	sensor connected, assembly 14, sn 55, range 18
2018-12-11 13:30:37	started thread proc
1) data transfer   2)	calibration   3) measure   4) move zero?

5. Make a selection by typing a number [1-4]:

1 - Test the data transfer command by setting the measurement position to 10.5

mm.

- 2 Test the calibration process.
- 3 Test the measurement process.
- 4 Test the "move to zero" process.



# 12.6. Diagnostic messages

The I-7580 module has two types of diagnostic messages: "Output Data Error" and "Input Data Error".

Туре	Description
Output Data Error	FIFO overflow.
	Data loss.
Input Data Error	FIFO overflow.

## 12.6.1. Output Data Error

- 1. When the PROFINET network speed is higher than the serial network speed and the PROFINET IO controller continuously transmits data to the I-7580 module, the output buffer of the I-7580 module will overflow, and the I-7580 module will send a diagnostic message "Output Data Error – FIFO overflow".
- 2. When the I-7580 module receives the data output command (first byte of the output data area, please refer to section "PROFINET Output Data Area") from the PROFINET IO controller and the command is not increased continuously (for example: 0->1, 1->2 ... 254->255, 255->0), the I-7580 module will send a diagnostic message "Output Data Error Data loss" to the PROFINET IO controller.

## 12.6.2. Input Data Error

- 1. When the serial network speed is higher than the PROFINET network speed and the serial device continuously transmits data to the I-7580 module, the input buffer of the I-7580 module will overflow, and the I-7580 module will send a diagnostic message "Input Data Error – FIFO overflow".
- 2. When the I-7580 module cannot receive data in time from the COM port, it will send a diagnostic message "Input Data Error Data loss". Please refer to section "PROFINET Input Data Area".
- The maximum input data length for the COM port of the I-7580 module is 506 bytes. When the COM port of the I-7580 module receives data larger than 506 bytes, it will send a diagnostic message "Input Data Error – Data overflow".

# 13. Intended use

## 13.1. Preparation for use

- Check the condition of the output window of a laser sensor and, if necessary, wipe it with a soft cloth.
- Rotate a laser sensor by hand and check the smooth progress.
- Check the cables and power supply.
- Make sure that the network settings are correct.
- Switch on the system.
- Run the test procedures. Please refer to section <u>12.5.</u> "Communication tests".

## 13.2. Measurements

Run the sequence of commands described in section <u>12.4.</u> "Communication between PLC and system".



# 14. Technical support

Technical assistance related to incorrect operation of the system and to problems with a service program is free. Requests for technical assistance should be addressed at <a href="mailto:support@riftek.com">support@riftek.com</a>.

# 15. Warranty policy

Warranty assurance for the Pipe ID Control System RF096-35/55-100 Series - 24 months from the date of putting in operation; warranty shelf-life - 12 months.

# 16. Revisions

Date	Revision	Description
12.12.2018	1.0.0	Starting document.

# 17. Distributors

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